

WHAT IS CLAIMED IS:

1. A water-soluble film comprising a blend of polyvinyl alcohol and a sulfonate polymer.
- 5 2. A film according to claim 1 wherein said sulfonate polymer contains a sulfo group in the form of $-\text{SO}_3\text{M}$, wherein M is hydrogen, sodium, potassium or ammonium.
- 10 3. A film according to claim 2 wherein said blend contains 0.01 to 60 weight percent of said sulfonate polymer.
4. A film according to claim 2 wherein said blend contains 0.1 to 50 weight percent of said sulfonate polymer.
- 15 5. A film according to claim 2 wherein said blend contains 1 to 40 weight percent of said sulfonate polymer.
6. A film according to claim 2 wherein said sulfonate polymer is a homopolymer or a co-polymer formed by free-radical polymerization of sulfonate monomers.
- 20 7. A film according to claim 6 wherein said sulfonate monomer is derived from one of 2-chloroethylene sulfonic acid, ethylenesulfonic acid, ethylenedisulfonic acid, 1-nitriloethylenesulfonic acid, 2-formylethylenesulfonic acid, 1-carboxyethylenesulfonic acid, 1-propene-1-sulfonic acid, 1-propene-2-sulfonic acid, 2-formyl-1-methylethylene sulfonic acid, 1-carboxy-2-methylethylene sulfonic acid, 2-methyl-1,3-propenedisulfonic acid, 1-butene-1-sulfonic acid, 1-carboxy-2,2-dimethyl-ethylene sulfonic acid, 1-pentene-1-sulfonic acid, 1-hexene-1-sulfonic acid, 2-(p-nitrophenyl) ethylene sulfonic acid, 2-
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- phenylethylene sulfonic acid, 2-(p-hydroxyphenyl) ethylene sulfonic acid, 2-(2-aminophenyl) ethylene sulfonic acid, 1-methyl-2-phenylethylene sulfonic acid, 2-(p-methoxyphenyl) ethylene sulfonic acid, 4-phenyl-1,3-butadiene sulfonic acid, 2-(p-acetamidophenyl) ethylene sulfonic acid, 3-chloroallyl sulfonic acid, allyl sulfonic acid, 1-hydroxyallyl sulfonic acid, 2-cynoallyl sulfonic acid, 3-chloromethallyl sulfonic acid, 1-carboxyallyl sulfonic acid, 3-carboxyallyl sulfonic acid, methallyl sulfonic acid, 2-methylene-4,4-dimethyl-1,3-disulfo-pentene, 4-methylene-4,4-dimethyl pentene sulfonic acid, 1-hydroxy-3-phenylallyl sulfonic acid, 3-phenylallyl sulfonic acid, 2-benzylallyl sulfonic acid, 2-(p-methylphenoxy) allyl-sulfonic acid, 3-phenoxy-methallyl sulfonic acid, 2-sulfoethyl acrylate, 2-sulfoethyl maleate, 3-sulfopropyl acrylate, 2-sulfonyl methacrylate, 3-sulfopropyl acrylate, 2-sulfo-1-(sulfomethyl) ethyl methacrylate, 3-sulfopropyl maleate, 4-sulfobutyl methacrylate, 2-(acyloxymethyl)-c-sulfuran, bis-2-sulfoethyl fumarate, 3-sulfopropyl itaconate, p-sulfophenyl acrylate, 2-(2-methylacryloxymethyl)-sulfofuran, bis(2-sulfoethyl) itaconate, p-sulfophenyl methacrylate, bis(3-sulfopropyl) maleate, bis(3-sulfopropyl) fumarate, bis (2-sulfopropyl) maleate, bis(2-sulfopropyl) fumarate, 5-methyl-2-(methallyloxy) benzene sulfonic acid, bis(2-sulfopropyl) itaconate, ar-(2-acryloyloxyethoxy)-2-naphthalene sulfonic acid, ar-(2-methacryloyloxyethoxy)-naphthalene sulfonic acid, dodecyl-4-sulfopropyl itaconate, dodecyl-4-sulfobutyl itaconate, n-acryloyl taurine, allylthioethyl sulfonic acid, alloxy propene sulfonic acid, n-allyl-n-methylaminoethane-sulfonic acid, n-(methacrylamidomethyl)-sulfoacetamide, vinyloxybenzene sulfonic acid, n-(p-sulfophenyl) methacrylamide, p-[(2-vinylsulfonyl)ethoxy]-benzene sulfonic acid, n-methyl-n-(2-vinylsulfonyl-ethyl)-p-(sodiumsulfo) benzyl amine, dichlorostyrene sulfonic acid, 2-chlorostyrene sulfonic acid, p-styrene sulfonic acid, p-sulfonic acid, vinyltoluene sulfonic acid, 2-methyl styrene sulfonic acid, the potassium, sodium and ammonium salts of

each of the foregoing compounds, 4-methylene-2,2,6,6-tetramethyl-3,5-disulfoheptene, allyloxyethyl sulfonic acid, allyl oxybenzene sulfonic acid, and styrene sulfonic acid.

- 5 8. A film according to claim 2 wherein said sulfonate polymer is made by condensation polymerization of formaldehyde with sulfonate monomers.
- 10 9. A film according to claim 8 wherein said sulfonate monomers are derived from one or more of aminophenol sulfonic acid, 2-amino-4-chloro-phenyl sulfonic acid, 2-amino-1-naphalene sulfonic acid, 1-amino-8-naphthol-3,5 disulfonic acid, amino-naphalene trisulfonic acid, aminobenzene-2,5 disulfonic acid, diaminostilbene sulfonic acid, phenol sulfonic acid, amino-naphthol disulfonic acid, and aminodiphenylamine methane sulfonic acid.
- 15 10. A film according to claim 2 wherein said sulfonate polymer includes sodium sulfonic styrene.
- 20 11. A film according to claim 2 wherein said sulfonate polymer is one of sulfonated polystyrene, sulfonated polysulfone, sulfonated melamine-formaldehyde resin, sulfonated phenol-formaldehyde resin, sulfonated urea-formaldehyde resin, sulfonated naphthalene-formaldehyde resin, sulfonated ethyl cellulose, sulfonated polyurethane, sulfonated
- 25 polypropylene glycol, and sulfonated polyethylene glycol.
12. A film according to claim 2 wherein said sulfonate polymer has a number average molecular weight in the range of 18,000 - 26,000.
- 30 13. A film according to claim 2 wherein said blend includes a film-forming additive.

14. A film according to claim 13 wherein said additive is present in the range of 0.1 - 18% by weight.
15. A film according to claim 13 wherein said additive is a wetting agent, filler, plasticizer, antioxidant, mold-releasing agent, biocide, anti-blocking agent, defoamer or lubricant.
16. A container made from the film of claim 2.
- 10 17. A composition for forming a water-soluble film, comprising a blend of polyvinyl alcohol and a sulfonate polymer.
- 15 18. A composition according to claim 17 wherein said sulfonate polymer contains a sulfo group in the form of $-\text{SO}_3\text{M}$, where M is hydrogen, sodium, potassium or ammonium.